REMARKS

Claims 1, 4-9, and 11-33 are pending, with claims 1 and 30 being independent. Claims 1, 13, and 30 have been amended; claim 10 has been canceled; and claims 31-33 have been added. Support for the new claims can be found in the originally-filed specification, at least at page 12, lines 15-28 and Fig. 4b. No new matter has been introduced.

Claim Objections

Claim 13 has been objected to because the term "free space propagation path" lacks antecedent basis. Applicant has amended claim 13 to provide antecedent basis for this term. Accordingly, applicant requests withdrawal of the objection of claim 13.

Claim Rejections – 35 U.S.C. §102

Independent claim 1 recites an optical fiber for producing laser radiation at a characteristic wavelength. The optical fiber includes a first multimode core region having a first index of refraction, and an active region embedded within the core region for producing radiation at the characteristic wavelength when pumped by pump radiation. The core region is adapted for guiding the laser radiation in a longitudinal direction of the fiber and is adapted for guiding pump radiation. The active region has a sufficiently small transverse dimension such that less than about 10% of the radiation produced at the characteristic wavelength in the active region is confined to the active region and such that the optical fiber has a gain along its longitudinal direction that is sufficiently small so that a desired laser mode operates above a lasing threshold while all other modes operate below the lasing threshold.

Independent claim 30 recites a method of providing laser energy with a characteristic wavelength in a single optical mode to a surface. The method includes pumping an active region embedded in a multimode optical fiber with pump energy to produce the laser energy with the characteristic wavelength. The active region has a transverse dimension smaller than the characteristic wavelength. The method also includes guiding the generated light to the surface with the multimode fiber through a first multimode core region having a first index of refraction.

Additionally, a gain along a longitudinal direction of the optical fiber is reduced to a value that is sufficiently small so that a desired laser mode operates above a lasing threshold while all other modes operate below the lasing threshold by confining less than about 10% of the radiation produced at the characteristic wavelength in the active region within the active region by making the transverse dimension of the active region sufficiently small.

Claims 1, 4-6, 8-11, and 25-30 have been rejected as being anticipated by U.S. Patent No. 5,027,079 (Desurvire). Applicant requests withdrawal of the rejection because Desurvire fails to describe or suggest an active region having a sufficiently small transverse dimension such that less than about 10% of the radiation produced at the characteristic wavelength in the active region is confined to the active region and such that the optical fiber has a gain along its longitudinal direction that is sufficiently small so that a desired laser mode operates above a lasing threshold while all other modes operate below the lasing threshold, as recited in independent claim 1 and as similarly recited in independent claim 30.

Desurvire relates to an erbium doped fiber amplifier in which an index of refraction 50 of an erbium doped core is greater than an index of refraction 52 of a cladding. See Desurvire at col. 5, lines 18-31 and Fig. 3. The curve 54 of the pump mode is shown in Fig. 3 superimposed on the plot of the indices of refraction 50, 52. See Desurvire at col. 5, lines 31-33 and Fig. 3. The Examiner points to col. 3, lines 40-56 of Desurvire to somehow suggest an active region of Desurvire's core in which less than about 10% of the radiation produced at the characteristic wavelength in the active region is confined to the active region. However, this passage of Desurvire merely explains that as the pump power applied to the fiber is increased, initially, the loss due to ground level absorption decreases, then a higher proportion of rare earth ions are in their excited state and stimulated emission from the upper lasing state to the ground state becomes stronger than the absorption from the ground state to the upper lasing state, to produce a positive gain at various wavelengths. This passage therefore merely describes how the fiber begins to exhibit laser properties; there is nothing in the passage to suggest that an active region of Desurvire's core in which less than about 10% of the radiation produced at the characteristic wavelength in the active region is confined to the active region.

The Examiner also points to Fig. 11 of Desurvire to show that as the core radius is reduced, the gain coefficient increases. Fig. 11 shows a gain coefficient at two pump wavelengths for various values of the doping parameter ε, where the doping parameter ε is a ratio of the radius of the erbium doped core to the radius of the fiber. While Fig. 11 suggests that the radius the erbium doped core can be varied relative to the radius of the fiber, there is nothing in Fig. 11 to suggest that the less than about 10% of the radiation produced at the characteristic wavelength in the erbium doped core would be confined to the erbium doped core such that the optical fiber has a gain along its longitudinal direction that is sufficiently small so that a desired laser mode operates above a lasing threshold while all other modes operate below the lasing threshold. Rather, Fig. 11 suggests that the gain coefficient can be increased by reducing the radius of the erbium doped core relative to the radius of the fiber.

Accordingly, none of the rejected claims are anticipated by Desurvire, and applicant requests withdrawal of this rejection.

Claim Rejections – 35 U.S.C. §103

Various ones of applicant's claims depending from claim 1 have been rejected as obvious over combinations of Desurvire with secondary references. However, as none of these references supplies that which is lacking in Desurvire with respect to claim 1, as discussed above, and such distinguishing features are not such that would have been supplied by mere ordinary skill in the art at the time of the invention, applicant submits that all of their dependent claims are allowable as depending from an allowable base claim.

Claim 7 has been rejected as being unpatentable over Desurvire in view of U.S. Patent No. 6,970,631 (Arbore). Claim 7 depends from claim 1, which was rejected as being anticipated by Desurvire. As discussed above, Desurvire fails to describe or suggest an active region having a sufficiently small transverse dimension such that less than about 10% of the radiation produced at the characteristic wavelength in the active region is confined to the active region and such that the optical fiber has a gain along its longitudinal direction that is sufficiently small so that a desired laser mode operates above a lasing threshold while all other modes operate below the

lasing threshold, as recited in independent claim 1. Arbore does not remedy the failure of Desurvire to describe or suggest the feature of the invention as claimed.

Arbore relates to a fiber amplifier 10 including a core 12 surrounded by a depressed cladding 14, which is surrounded by a secondary cladding 16 and an outer cladding 20. See Arbore at col. 5, lines 28-41 and Fig. 1. The fiber amplifier 10 produces an intensity distribution of radiation in a core mode 24 at a wavelength $\lambda 1$ that is less than a cutoff wavelength λc and an intensity distribution of radiation in a cladding mode 26. See Arbore at col. 5, line 58 to col. 6, line 13 and Fig. 1. However, the core 12 is not configured such that less than about 10% of the radiation produced in the core 12 is confined to the core 12. Rather, as the Examiner concedes and as is suggested by Fig. 1 of Arbore, substantially more radiation is confined to the core 12 in Arbore's configuration.

Moreover, one of ordinary skill in the art would not have been motivated to modify Desurvire to provide for confinement, where the optical fiber has a gain along its longitudinal direction that is sufficiently small so that a desired laser mode operates above a lasing threshold while all other modes operate below the lasing threshold because Desurvire teaches away from such a configuration and suggests that the gain should instead be increased. See Desurvire at col. 9, line 63 to col. 10, line 3. For at least these additional reasons, applicant submits that claim 7 is allowable over any proper combination of Desurvire and Arbore.

Claims 12-14 and 18 have been rejected as being unpatentable over Desurvire in view of U.S. Patent No. 6,954,575 (Fermann). Claims 12-14 and 18 depend from claim 1, which was rejected as being anticipated by Desurvire. Fermann does not remedy the failure of Desurvire to describe or suggest an active region having a sufficiently small transverse dimension such that less than about 10% of the radiation produced at the characteristic wavelength in the active region is confined to the active region and such that the optical fiber has a gain along its longitudinal direction that is sufficiently small so that a desired laser mode operates above a lasing threshold while all other modes operate below the lasing threshold, as recited in independent claim 1. Fermann relates to an optical fiber including a core and a cladding around the core. See Fermann at Figs. 1 and 4A-7C. However, there is no description or suggestion in

Fermann that less than about 10% of the radiation produced in the core is confined in the core. For at least these reasons, any possible combination of Desurvire and Fermann would still fail to describe or suggest an active region having a sufficiently small transverse dimension such that less than about 10% of the radiation produced at the characteristic wavelength in the active region is confined to the active region and such that the optical fiber has a gain along its longitudinal direction that is sufficiently small so that a desired laser mode operates above a lasing threshold while all other modes operate below the lasing threshold, as recited in claim 1. Claims 12-14 and 18 are therefore also allowable.

Claims 15-17 have been rejected as being unpatentable over Desurvire in view of U.S. Patent No. 6,445,838 (Caracci). Claims 15-17 depend from claim 1, which was rejected as being anticipated by Desurvire. Caracci does not remedy the failure of Desurvire to describe or suggest an active region having a sufficiently small transverse dimension such that less than about 10% of the radiation produced at the characteristic wavelength in the active region is confined to the active region and such that the optical fiber has a gain along its longitudinal direction that is sufficiently small so that a desired laser mode operates above a lasing threshold while all other modes operate below the lasing threshold, as recited in independent claim 1. Caracci relates to an optical component in which optical fibers 281, 282 are mounted. See Caracci at col. 4, lines 46-56 and Fig. 1. However, there is no description or suggestion in Caracci that less than about 10% of the radiation produced in a core of the fibers 281, 282 is confined in the core. For at least these reasons, any possible combination of Desurvire and Caracci would still fail to describe or suggest an active region in which less than about 10% of the radiation produced at the characteristic wavelength in the active region is confined to the active region, as recited in claim 1. Thus, claims 15-17 are also allowable.

Claims 19 and 20 have been rejected as being unpatentable over Desurvire in view of U.S. Patent No. 5,774,484 (Wyatt). Claims 19 and 20 depend from claim 1, which was rejected as being anticipated by Desurvire. Wyatt does not remedy the failure of Desurvire to describe or suggest an active region having a sufficiently small transverse dimension such that less than about 10% of the radiation produced at the characteristic wavelength in the active region is

confined to the active region and such that the optical fiber has a gain along its longitudinal direction that is sufficiently small so that a desired laser mode operates above a lasing threshold while all other modes operate below the lasing threshold, as recited in independent claim 1. Wyatt relates to a laser including a multimode fiber 1. See Wyatt at col. 5, lines 15-32 and Fig. 1. However, there is no description or suggestion in Wyatt that less than about 10% of the radiation produced in a core of the fiber 1 is confined in the core. For at least these reasons, any possible combination of Desurvire and Wyatt would still fail to describe or suggest an active region having a sufficiently small transverse dimension such that less than about 10% of the radiation produced at the characteristic wavelength in the active region is confined to the active region and such that the optical fiber has a gain along its longitudinal direction that is sufficiently small so that a desired laser mode operates above a lasing threshold while all other modes operate below the lasing threshold, as recited in independent claim 1. Thus, claims 19 and 20 are also allowable.

Claims 21-24 have been rejected as being unpatentable over Desurvire in view of U.S. Publication No. 2002/0018287 (Zellmer). Claims 21-24 depend from claim 1, which was rejected as being anticipated by Desurvire. Zellmer does not remedy the failure of Desurvire to describe or suggest an active region having a sufficiently small transverse dimension such that less than about 10% of the radiation produced at the characteristic wavelength in the active region is confined to the active region and such that the optical fiber has a gain along its longitudinal direction that is sufficiently small so that a desired laser mode operates above a lasing threshold while all other modes operate below the lasing threshold, as recited in independent claim 1. Zellmer relates to a fiber optic amplifier including a radiation source 12 having a signal beam that reamplified in an active amplifier fiber 12. See Zellmer at paragraph 0019 and Fig. 1. However, there is no description or suggestion in Zellmer that less than about 10% of the radiation produced in a core of the fiber 12 is confined in the core. For at least these reasons, any possible combination of Desurvire and Zellmer would still fail to describe or suggest the combination of features recited in claim 1. Thus, claims 21-24 are also allowable.

Furthermore, each of the proposed combinations of secondary references with Desurvire must be considered in light of Desurvire's teachings that applicant submits would have lead the ordinarily skilled artisan away from, rather than toward, the subject matter of the claims. Applicant respectfully submits that these proposed combinations fail to show a prima facie case of obviousness and request that such rejections be reconsidered and withdrawn.

Conclusion

Applicant submits that all claims are in condition for allowance. Please charge our PTO Deposit Account 06-1050 for the fees in the amount of $1,050.00 for the Three Month Extension of Time to and including December 4, 2007. Please apply any other charges or credits to Deposit Account No. 06-1050, referencing Docket No. 14624-004001.

Respectfully submitted,

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